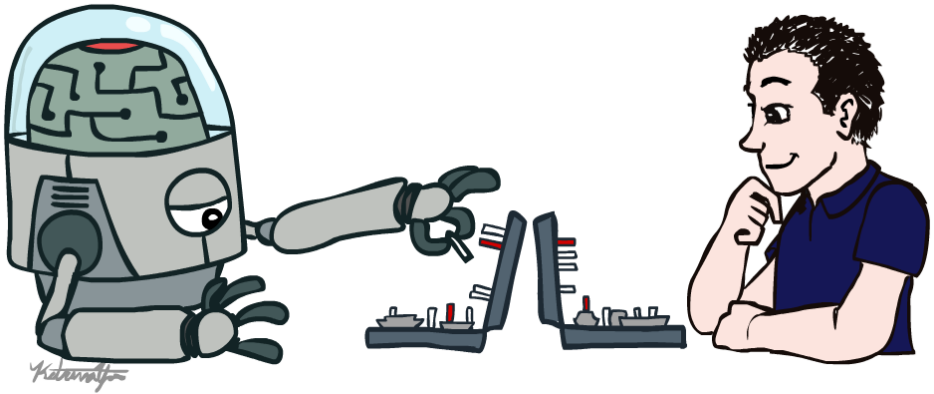
# Artificial Intelligence

## Introduction



Instructor : Syed Ahmed Qasim

Slides adapted from: ai.berkeley.edu

# Course Information

## 4 Credit Hour Course with Lab

## Marks Distribution:

- Course: 75% (or 3 credit hours):
  - Quizzes – 15%
  - Assignments – 10%
  - Mid Term Exam – 25%
  - Final Exam – 50%
  - Will be normalized to 75%

- Lab: 25% (or 1 credit hour):
  - Lab Assignments (Assessed through Viva) – 25%
  - Midterm (could be Project) – 25%
  - Final Term (could be Project) – 50%
  - Will be normalized to 25%
- Fixed grading scale

# Textbook, Course Outline

Course Outline will be shared

**Textbook:**

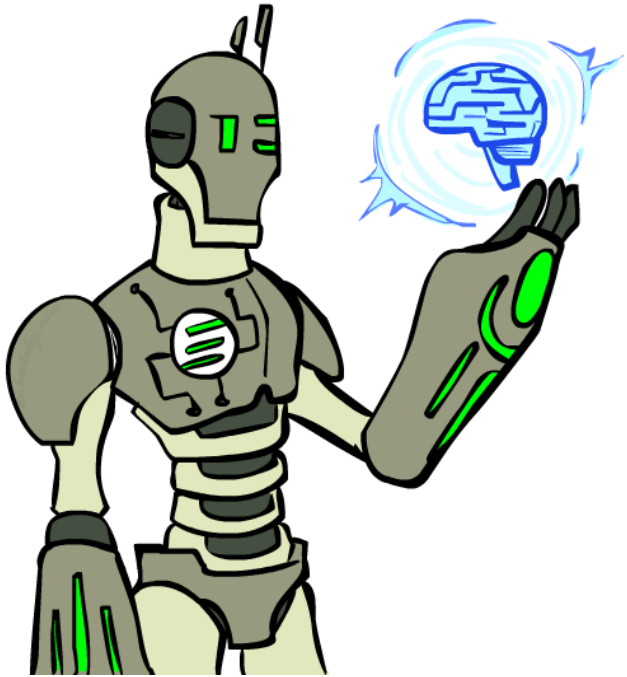
- Artificial Intelligence: A Modern Approach, Russell, S., and Norvig, P., Pearson, 2020.

**Reference Book:**

- Artificial Intelligence Basics: A Non-Technical Introduction, Taulli, T., Apress, 2019

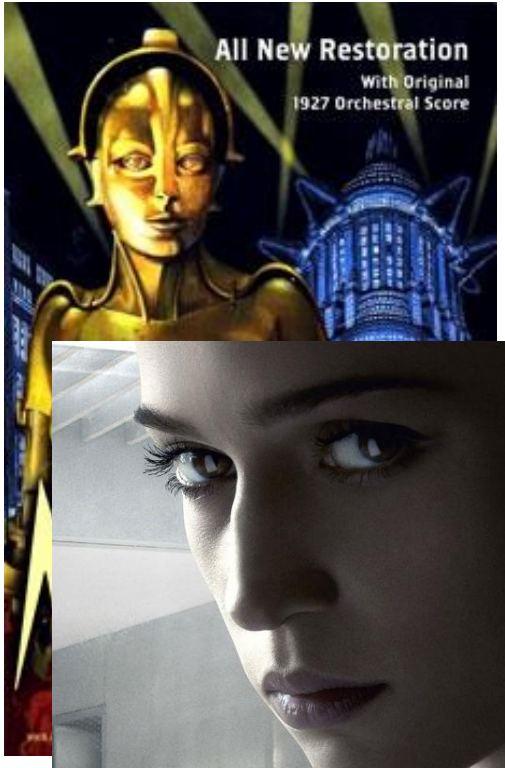
# Today

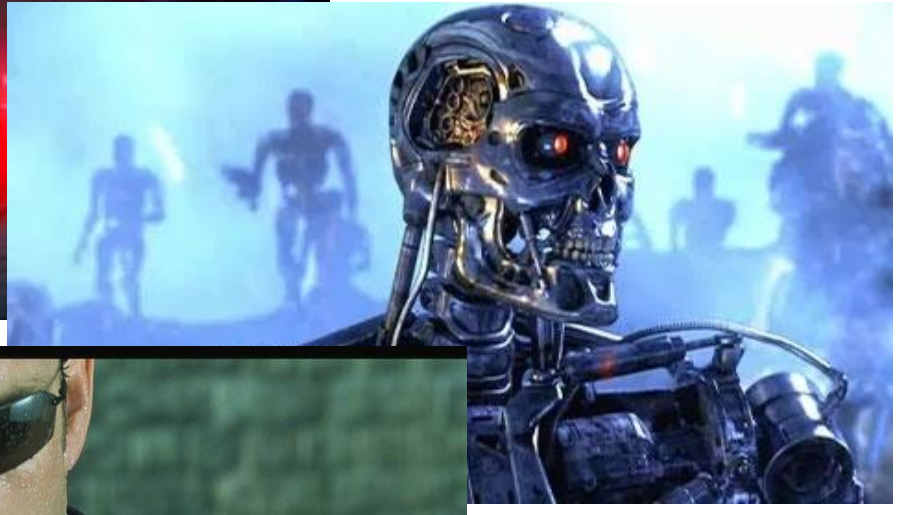
- What is artificial intelligence?
- Where are we and how did we get here?
- How do we think about the design of AI systems?



# Movie AI


# Movie AI






YESTERDAY DR. WILL CASTER WAS ONLY HUMAN
JOHNNY DEPP
REBECCA HALL
PAUL BETTANY
KATE MARA
CILLIAN MURPHY
AND MORGAN FREEMAN
TRANSCENDENCE
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# News AI

AI is the biggest risk we face as a civilisation, Elon Musk says

**Billionaire burn: Musk says Zuckerberg's understanding of AI threat 'is limited'**

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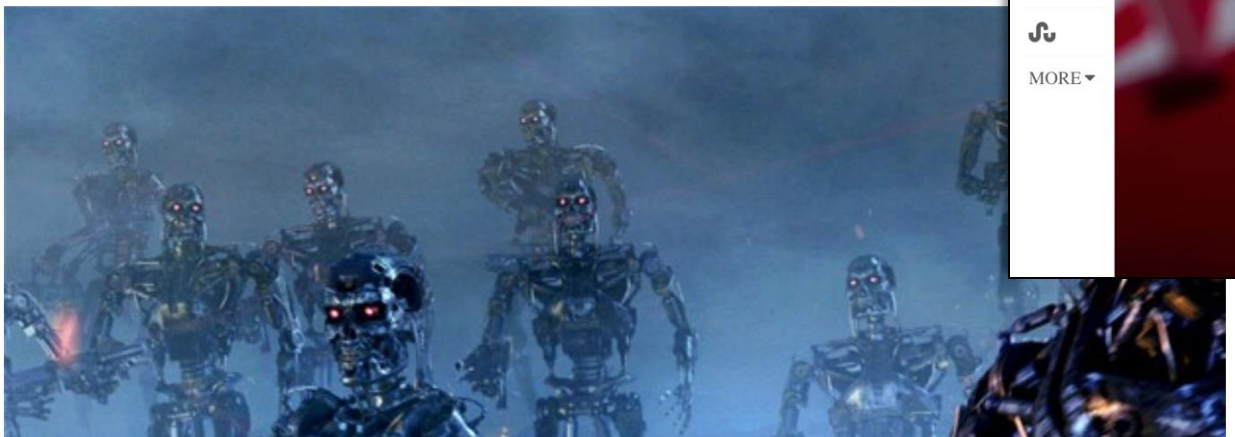
'Sociopathic' robots could overrun the human ra a generation

Computers should be trained to serve humans to reduce their th human race, says a leading expert on artificial intelligence



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By Mindy Weisberger, Senior Writer | October 30, 2017 03:39pm ET

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# News AI

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## United Kingdom Plans $1.3 Billion Intelligence Push

## France to spend $1.8 billion on compete with U.S., China

## EU wants to invest £18b development

## China's Got a Huge Art Intelligence Plan

## 'Whoever leads in AI will rule the world': Putin to Russian children on Knowledge Day

Published time: 1 Sep, 2017 14:08
Edited time: 1 Sep, 2017 14:40

# News AI


## IBM's Watson Jeopardy Computer Shuts Down Humans in Final Game

DAILY NEWS 9 March 2016

Sili

## ‘I’m in shock!’ Ho world’s best hum

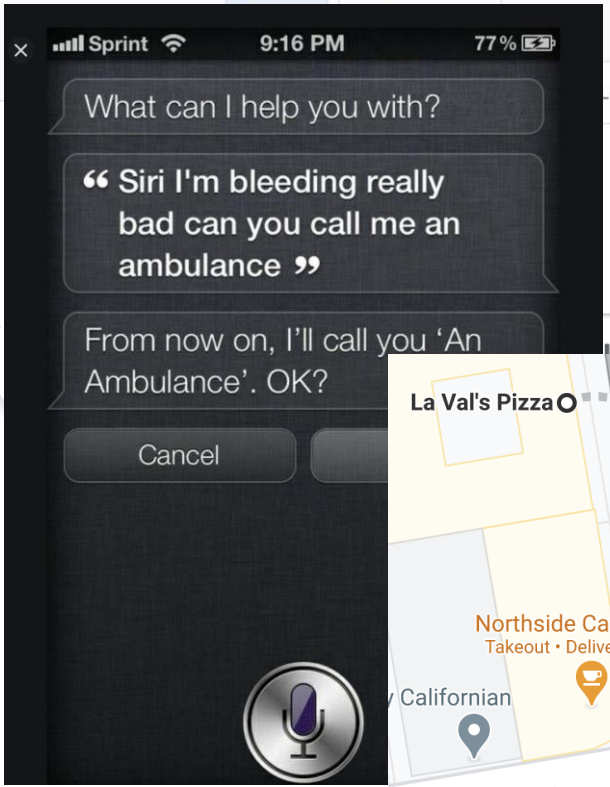

## Blizzard will show off Google's Deepmind AI in StarCraft 2 later this week

By Andy Chalk 4 hours ago

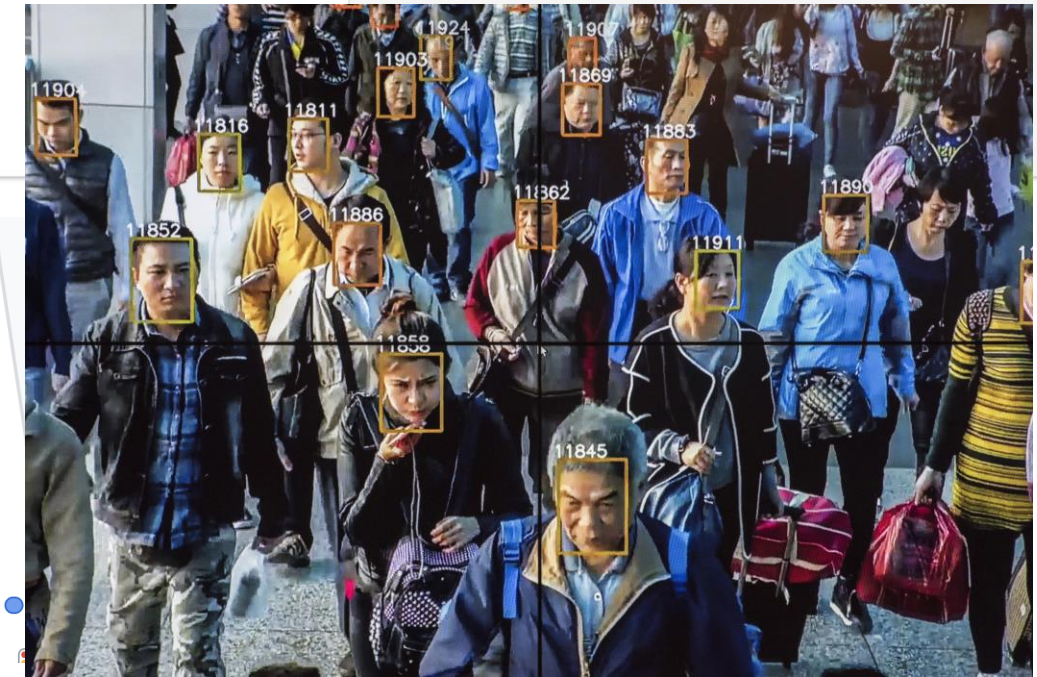
**Google and Blizzard launched the artificial intelligence project in 2016.**

COMMENTS

# Real AI


Sprint
9:16 PM
77 %
What can I help you with?
“ Siri I'm bleeding really bad can you call me an ambulance ”
From now on, I'll call you 'An Ambulance'. OK?
Cancel


La Val's Pizza
Ave
Northside Cafe
Takeout • Delivery
Californian


Google Translate
SPANISH
CHINESE (TRADITIONAL)
ENGLISH
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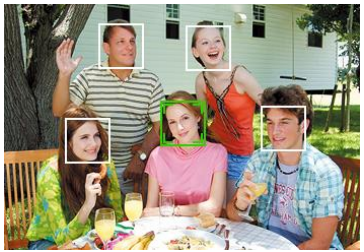
# Artificial Intelligence in Real Life

## A young *science* (≈ 50 years old)

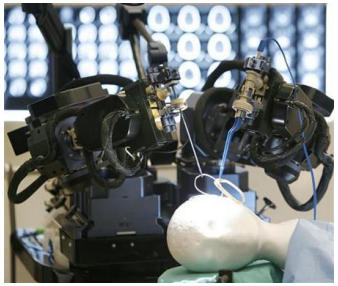
- Exciting and dynamic field, lots of uncharted territory left
- Impressive success stories
- "Intelligent" in specialized domains
- Many application areas





Face detection

Formal verification

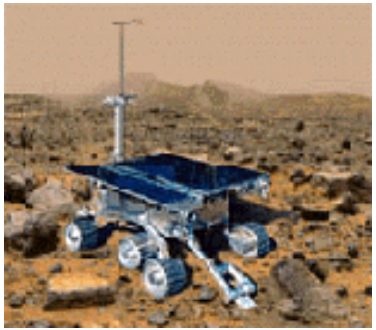



TUG
CAUTION
MAY CONTAIN
CHEMOTHERAPY DRUG
CAUTION
MAY CONTAIN
CHEMOTHERAPY DRUG


Boston Dynamics

# Why the interest in AI?

Labor



Science


Appliances

Google

YAHOO!

Search engines

Medicine/
Diagnosis

**What else?**

# What is artificial intelligence?

- There is no clear consensus on the definition of AI
- John McCarthy coined the phrase AI in 1956

*Q. What is artificial intelligence?*

A. It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human or *other* intelligence, but AI does not have to confine itself to methods that are biologically observable.

*Q. Yes, but what is intelligence?*

A. Intelligence is the computational part of the ability to achieve goals in the world. Varying kinds and degrees of intelligence occur in people, many animals and some machines.

# What is AI? (Cont'd)

| | |
|---|---|
| "The exciting new effort to make computers think ... *machines with minds*, in the full and literal sense" (Haugeland, 1985)<br><br>"[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning ..." (Bellman, 1978) | "The study of mental faculties through the use of computational models" (Charniak and McDermott, 1985)<br><br>"The study of the computations that make it possible to perceive, reason, and act" (Winston, 1992) |
| "The art of creating machines that perform functions that require intelligence when performed by people" (Kurzweil, 1990)<br><br>"The study of how to make computers do things at which, at the moment, people are better" (Rich and Knight, 1991) | "A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes" (Schalkoff, 1990)<br><br>"The branch of computer science that is concerned with the automation of intelligent behavior" (Luger and Stubblefield, 1993) |

**Figure 1.1** Some definitions of AI. They are organized into four categories:

| | |
|---|---|
| Systems that think like humans. | Systems that think rationally. |
| Systems that act like humans. | Systems that act rationally. |

# Other possible AI definitions

AI is a collection of hard problems which can be solved by humans and other living things, but for which we don't have good algorithms for solving. e. g., understanding spoken natural language, medical diagnosis, circuit design, learning, self-adaptation, reasoning, chess playing, proving math theories, etc.

- Russell & Norvig: a program that
  - Acts like human (Turing test)
  - Thinks like human (human-like patterns of thinking steps)
  - Acts or thinks rationally (logically, correctly)

What is the scientific method hypothesis behind AI?

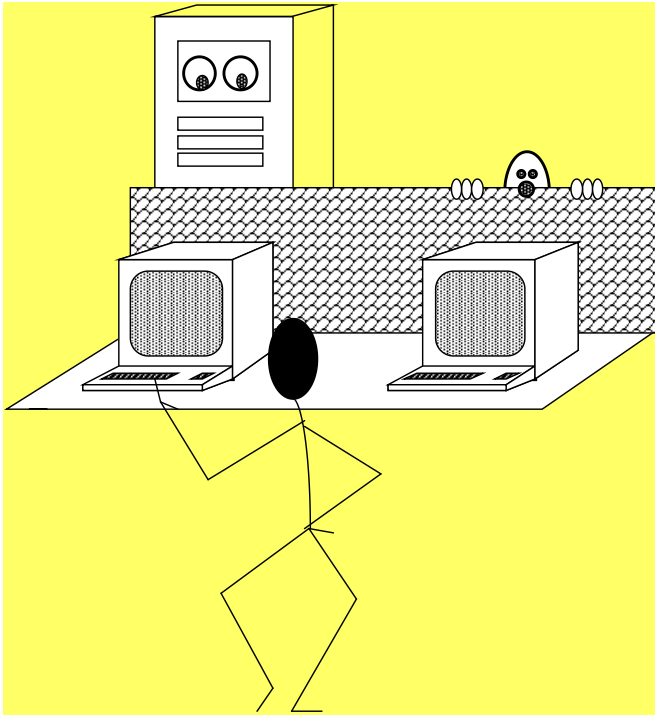
# One Working Definition of AI

Artificial intelligence is the study of how to make computers do things that people are better at or would be better at if:

- they could extend what they do to a World Wide Web-sized amount of data and
- not make mistakes.

# What is Intelligence?

## The Turing Test

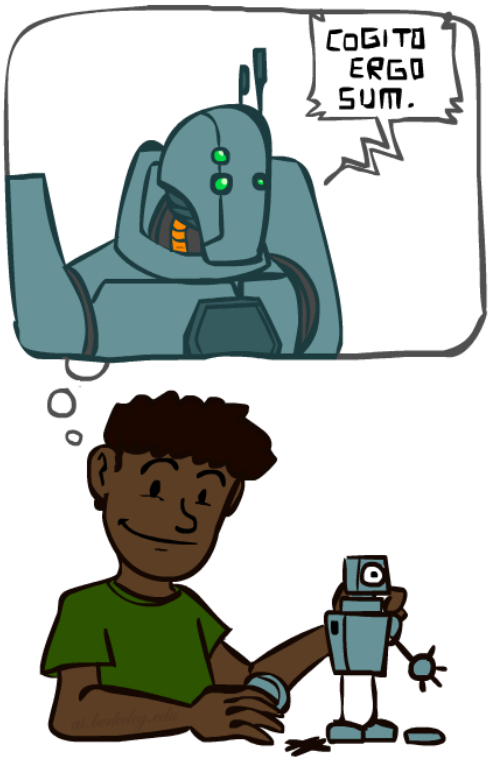


A machine can be described as a thinking machine if it passes the Turing Test. i.e. If a human agent is engaged in two isolated dialogues (connected by teletype say); one with a computer, and the other with another human and the human agent cannot reliably identify which dialogue is with the computer.

# Intelligence

- *Turing Test*: A human communicates with a computer via a teletype. If the human can't tell he is talking to a computer or another human, it passes.
  - Natural language processing
  - knowledge representation
  - automated reasoning
  - machine learning
- Add vision and robotics to get the total Turing test.

# A (Short) History of AI

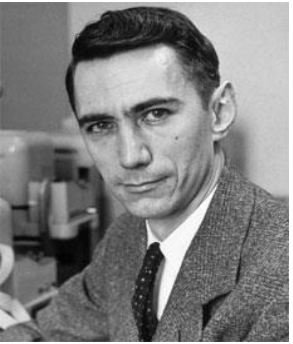


# A short prehistory of AI

- Prehistory:
  - **Philosophy** (reasoning, planning, learning, science, automation)
  - **Mathematics** (logic, probability, optimization)
  - **Neuroscience** (neurons, adaptation)
  - **Economics** (rationality, game theory)
  - **Control theory** (feedback)
  - **Psychology** (learning, cognitive models)
  - **Linguistics** (grammars, formal representation of meaning)
- Near miss (1842):
  - Babbage design for universal machine
  - Lovelace: “a thinking machine” for “all subjects in the universe.”

Aristotle: For if every instrument could accomplish its own work, obeying or anticipating the will of others . . . if, in like manner, the shuttle would weave and the plectrum touch the lyre without a hand to guide them, chief workmen would not want servants, nor masters slaves

# AI's official birth: Dartmouth, 1956

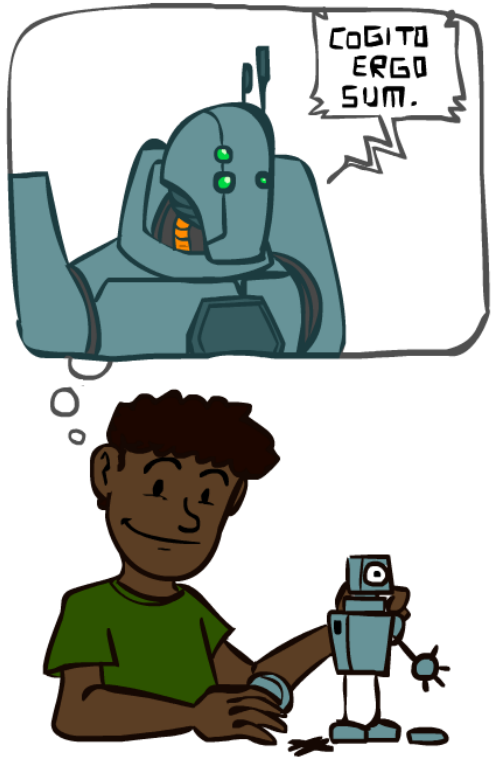


"An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. ***We think that a significant advance can be made if we work on it together for a summer."***

**John McCarthy and Claude Shannon**
**Dartmouth Workshop Proposal**

# A (Short) History of AI

- 1940-1950: Early days
  - 1943: McCulloch & Pitts: Boolean circuit model of brain
  - 1950: Turing's “Computing Machinery and Intelligence”
- 1950—70: Excitement: Look, Ma, no hands!
  - 1950s: Early AI programs: chess, checkers (RL), theorem proving
  - 1956: Dartmouth meeting: “Artificial Intelligence” adopted
  - 1965: Robinson's complete algorithm for logical reasoning
- 1970—90: Knowledge-based approaches
  - 1969—79: Early development of knowledge-based systems
  - 1980—88: Expert systems industry booms
  - 1988—93: Expert systems industry busts: “AI Winter”
- 1990— 2012: Statistical approaches + subfield expertise
  - Resurgence of probability, focus on uncertainty
  - General increase in technical depth
  - Agents and learning systems… “AI Spring”?
- 2012— ___: Excitement: Look, Ma, no hands again?
  - Big data, big compute, deep learning
  - AI used in many industries



# AI as Designing Rational Agents

- An **agent** is an entity that *perceives* and *acts*.
- A **rational agent** selects actions that maximize its expected **utility**.
- Characteristics of the **sensors, actuators, and environment** dictate techniques for selecting rational actions
- **This course** is about:
  - General AI techniques for many problem types
  - Learning to choose and apply the technique appropriate for each problem